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*Remarks:* Three specimens are distinguished by round curving instead of angulate lamellae on the adult stage. The variety occurs contemporaneously with typical *L. angulocostatus*.

*Lamellaptychus* aff. *angulocostatus* (PETERS)  
Pl. 5, Fig. 8

cf. 1961 *Lamellaptychus angulocostatus* var. *atlantica* (HENNIG), STEPHANOV, Pl. 1, Fig. 12, p. 215 (Bulgaria).

*Occurrence:* 126 m (105 m), MB81, J30883, above base of the Maiolica Formation.

*Age:* Barremian.

*Remarks:* From typical *L. angulocostatus* this specimen differs by its angular turning of the lamellae remarkably close to the symphyseal margin. In this respect it approximates *L. symphysocostatus* TRAUTH (1938, Pl. 14, Fig. 15, 16, p. 208) which, however, occurs lower in the section between 50 m (42 m) and 78 m (64 m).

*Lamellaptychus atlanticus* (HENNIG)  
Pl. 5, Fig. 14, 16

1913 *Aptychus atlanticus* (HENNIG, Pl. 2, Fig. 1a–b, p. 155).

1938 *Lamellaptychus angulocostatus* var. *atlantica* (HENNIG), TRAUTH, Pl. 14, Fig. 19, p. 210, refigured holotype.

1972 *Lamellaptychus angulocostatus atlanticus* (HENNIG), RENZ 1972, Pl. 4, Fig. 2a, 3, p. 617 (Hatteras Abyssal Plain).

1974 *Lamellaptychus atlanticus* HENNIG, HOUSA, Pl. 8, Fig. 2, p. 72.

1983 *Lamellaptychus angulocostatus atlanticus* (HENNIG), RENZ, Pl. 1, Fig. 3, p. 640 (Blake-Bahama Basin).

*Occurrence:* 133 m (110 m), MB87b, J30917, Pl. 5, Fig. 16.

144 m (119 m), DB 2720, J30900, Pl. 5, Fig. 14, above base of the Maiolica Formation.

*Remarks:* This small, widely known form shows angulate retroverse turning lamellae restricted on the juvenile stage. Soon the narrowly placed lamellae turn rounded and remain so until the adult stage.

#### E. Correlation of the Maiolica Formation in the Breggia river with the Blake-Bahama Formation in the North Atlantic (Fig. 3).

Accurately defined boundaries delimiting stages between Tithonian and Barremian, based on aptychi and on a few compressed ammonites have so far, not been established in holes drilled in the North Atlantic. Intervals with remains of Cephalopoda are scattered, particularly in the Atlantic (Holes 434A and 391C, Blake-Bahama Basin).

For the correlation proposed here two groups of observations are of fundamental importance.

a) Apparently synchronous changes in lithology observed in the western North Atlantic as well as in the Breggia section, suggesting correlations of the Rosso ad Aptici with the Cat Gap Formation and of the Maiolica with the Blake-Bahama Formation.

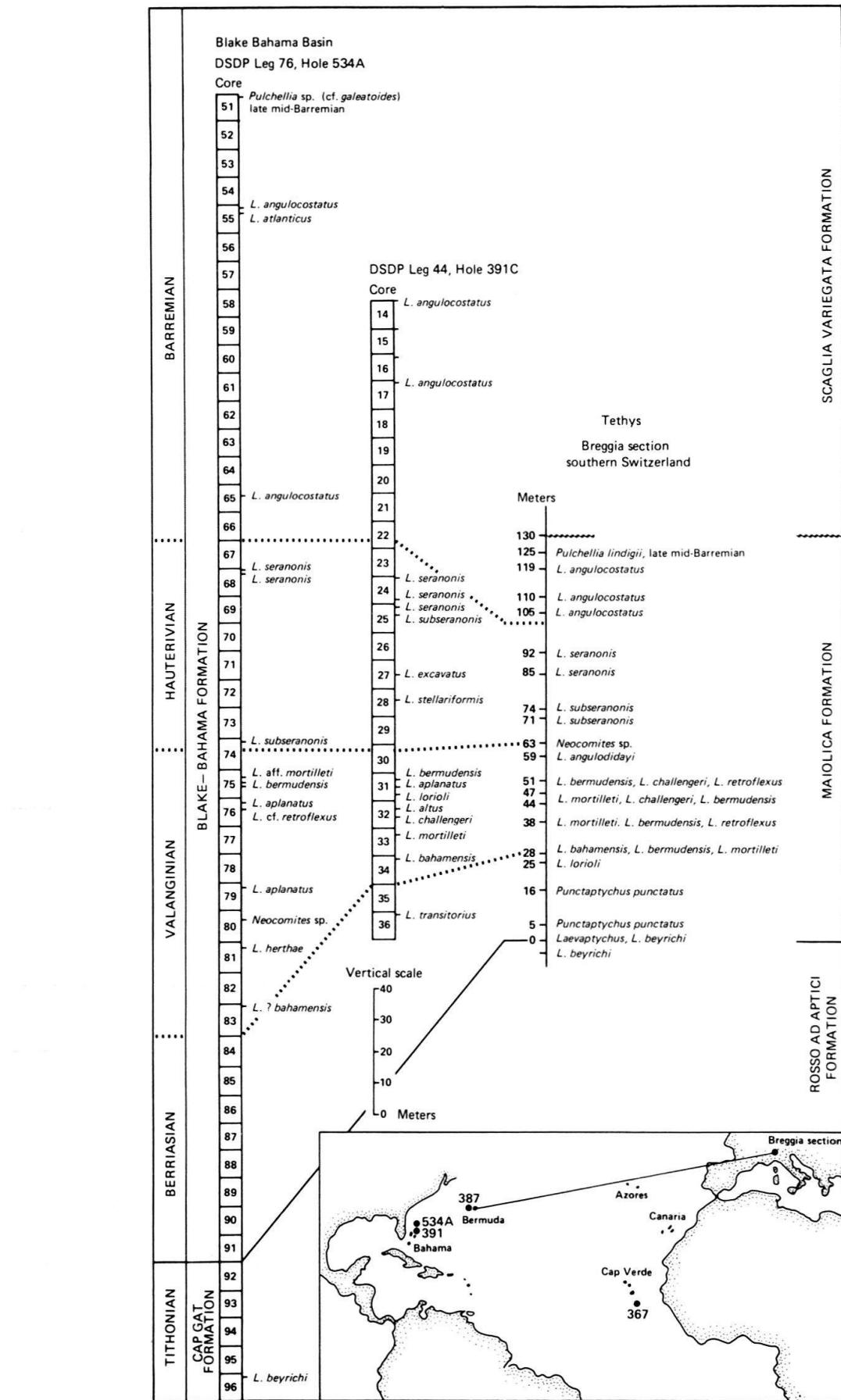


Fig. 3. Correlation of the Maiolica Formation with DSDP Leg 76, Hole 534A, and Leg 44, Hole 391C, in the Blake-Bahama Basin in the western Atlantic.

b) Within the Valanginian interval of the Breggia section a pronounced diversity of aptychi, coupled with an abundance of specimens, is observed. A similar concentration of identical species occurs within the upper part of the lower half of the Blake-Bahama Formation.

The considerable difference in thickness between the Blake-Bahama Formation and the Maiolica Formation is obviously due to factors not relevant to correlation, such as subsidence, sedimentation rate and diagenetic compaction which mainly affected the Maiolica Formation.

#### *Tithonian*

From the upper part of the purplish-coloured Cat Gap Formation, *Lamellaptychus beyrichi* (Hole 534A, Core 96, Tithonian) correlates with identical forms from the Rosso ad Aptici in the Breggia. Based on this observation a time equivalence of the Cat Gap Formation (Core 92 to 96) with the Rosso ad Aptici Formation is indicated. This correlation is confirmed also by calpionellids in the Blake-Bahama Formation (REMANE 1984, p. 561). We herewith can conclude that the change in facies from purplish marls (Cat Gap Formation) into white nannofossil ooze (Blake-Bahama Formation) coincides with the limit separating Jurassic (Tithonian) from Cretaceous (Berriasian).

*L. beyrichi* also has been mentioned from the red marls within a stratigraphical identical position, in southern Tuscany, in central Italy (KÄLIN et al., 1979).

#### *Berriasian (0 m to 28 m)*

From the lower part of the Blake-Bahama Formation (Hole 534A, Core 91 to 83), assumed to represent the Berriasian, no remains of Cephalopoda were obtained. In the lower 20 m of the Maiolica Formation, *Punctaptychus* indicating Berriasian, is the most outstanding guide fossil. It is obvious that the placement of the Berriasian–Valanginian boundary within the Blake-Bahama Formation must remain tentative.

#### *Valanginian (28 m to 63 m)*

The interval assumed to represent the Valanginian is distinguished by a conspicuous accumulation of different forms of aptychi in the Maiolica Formation, as well as in the Atlantic (Core 75 to about Core 82 in DSDP Leg 76, Hole 534A). Ammonites in the Maiolica Formation are restricted to Neocomitinae from the top of the interval assigned to the Valanginian at 75 m (63 m). In Hole 534A, Core 80, a partly preserved imprint, determined as *Neocomites* (Pl. 1, Fig. 16a–b, p. 641) suggests also a Valanginian age. Among aptychi *Lamellaptychus bermudensis* (Hole 391C, Pl. 1, Fig. 8, and Hole 534A, Pl. 1, Fig. 11) and *L. challengerii* (Hole 391C, Pl. 1, Fig. 4), so far assumed to be restricted to the Atlantic, were abundantly recovered from the interval supposed to be Valanginian in age in the Breggia. The two forms seem to represent very useful guide fossils indicating Valanginian.

#### *Hauterivian (63 m to 102 m)*

The Valanginian–Hauterivian boundary in Hole 534A has been placed near Core 73 and near Core 30 in Hole 391C, both in the Blake-Bahama Basin. These levels about

coincide with the 75 m (63 m) mark at the Maiolica section. Here, at the top of the Valanginian, a very conspicuous break in variability and abundance of aptychi can be observed, as displayed on the distribution chart (Fig. 2). This distribution of aptychi, we may assume, should also be reflected in ammonite assemblages from close to the Valanginian–Hauterivian boundary.

The intervals between 63 m and 92 m at the Maiolica section and between Core 67 to Core 68 in Hole 534A, and Core 24 to 25 in Hole 391C, both in the Blake-Bahama Basin, are dominated by aptychi distinguished by retroverse curving lamellae patterns. They belong to the group of *Lamellaptychus seranonis*, a form restricted according to present knowledge to the Hauterivian.

#### *Barremian (102 to 130 m)*

In the Blake-Bahama Basin (Hole 391A) and the Cape Verde Basin (Hole 367) considerable gaps without remains of Cephalopoda hamper the fixation of the Hauterivian–Barremian boundary.

Within the Maiolica section an interval (tunnel, Fig. 1) without aptychi of 9 m thickness separates the last *L. seranonis* (Hauterivian) from the first *L. angulocostatus*, a widely distributed form within the Tethys, indicating a Barremian age. The limit Hauterivian–Barremian thus remains unclear.

From 5 m below the top of the Maiolica Formation, near 125 m, an ammonite assemblage has been described by RIEBER (1977). The presence of *Pulchellia* and *Karsteniceras*, widely known from Europe (Spain) and northern South America (Colombia, Trinidad) represent a reliable indication for a Barremian age.

The discovery of *Pulchellia*, although flattened and poorly preserved, from Hole 534A in the Blake-Bahama Basin is of the greatest value for regional correlation. Our present correlation is based mainly on the occurrence of *Pulchellia* in Hole 534A, and in the Maiolica section.

#### **F. Conclusions**

The present study on aptychi assemblages from the Maiolica Formation in the river Breggia, based on detailed stratigraphic collecting of the fossils, permits a preliminary correlation with holes drilled in the northern Atlantic by the Deep Sea Drilling Project. Regional correlations, based on aptychi from sections exposed within the Tethyan realm of Europe have so far not been attempted, the main reason being the consecutive repetition of nearly identical lamellae patterns of aptychi during the Jurassic–Cretaceous Periods.

Specimens with very similar morphological features (homeomorph) occur within levels of quite different ages. In most publications on aptychi little attention has been paid to the stratigraphical order in spite of its significance for taxonomy. This is demonstrated by the synonymy lists included in the present paper.

The aptychi obtained from the Deep Sea Drilling Project provided an ideal opportunity for investigations of aptychi, this being a main reason for carrying out the present study.

At present we just begin to understand the biochronologic significance of aptychi assemblages, especially in sediments from the Tethys.